

Innovative Approaches for the Dissemination of Near Real-time GOES Data for Terrestrial and Space Weather Applications

Gary J. Jedlovec (NASA), Kevin M. McGrath (Jacobs), Paul J. Meyer (NASA), and Emily B. Berndt (NASA)

Earth Science Branch, NASA / Marshall Space Flight Center
Huntsville, Alabama

AGU Fall Meeting, Session IN-22B, Earth and Space Science Informatics, Near Real-Time Data Uses for Earth Science and Space Weather Applications



Access to Real-time GOES Data

- Access to real-time GOES satellite data is extremely valuable to the weather enterprise, however
 - Few real-time publically accessible data streams
 - Limited spatial coverage and channels, reduced resolution
 - Different data formats - imagery versus digital data
 - Expense of satellite receiving station
- GOES-R series satellites provide 3x spectral – 4x spatial – 5x faster creating an extremely valuable real-time data source for weather applications
 - Extremely large data volume
 - Few receiving stations with publically available data streams
- Develop and implement innovative dissemination strategies addressing past limitations
 - Application Programming Interface (API), Web Mapping Service (WMS), advanced storage and computing technology



TeleSpace Capella-GR from Enterprise Electronics Corporation (EEC)

Hardware

- ASC Signal 6.5-m reflector w/ motor controller
- Quorum GRB feedhorn and demodulator/receiver
- Linux workstations – acquisition, data processing, visualization

Software

- GEOSat, CSPP (v.0.4.4), AIT
- PROTEUS (visualization)

Data – (~60gbytes / day)

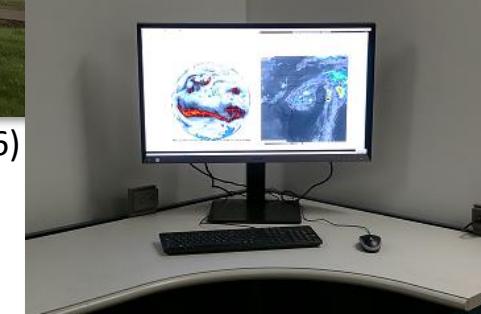
- 6 GOES-R series instruments data streams through GRB
- ABI – L1B; GLM – L2 (events, groups flashes)
- Space Wx: - L1B from EXIS, MAG, SEISS, and SUIVI



NASA MSFC receiving station at Activities Building (4316)



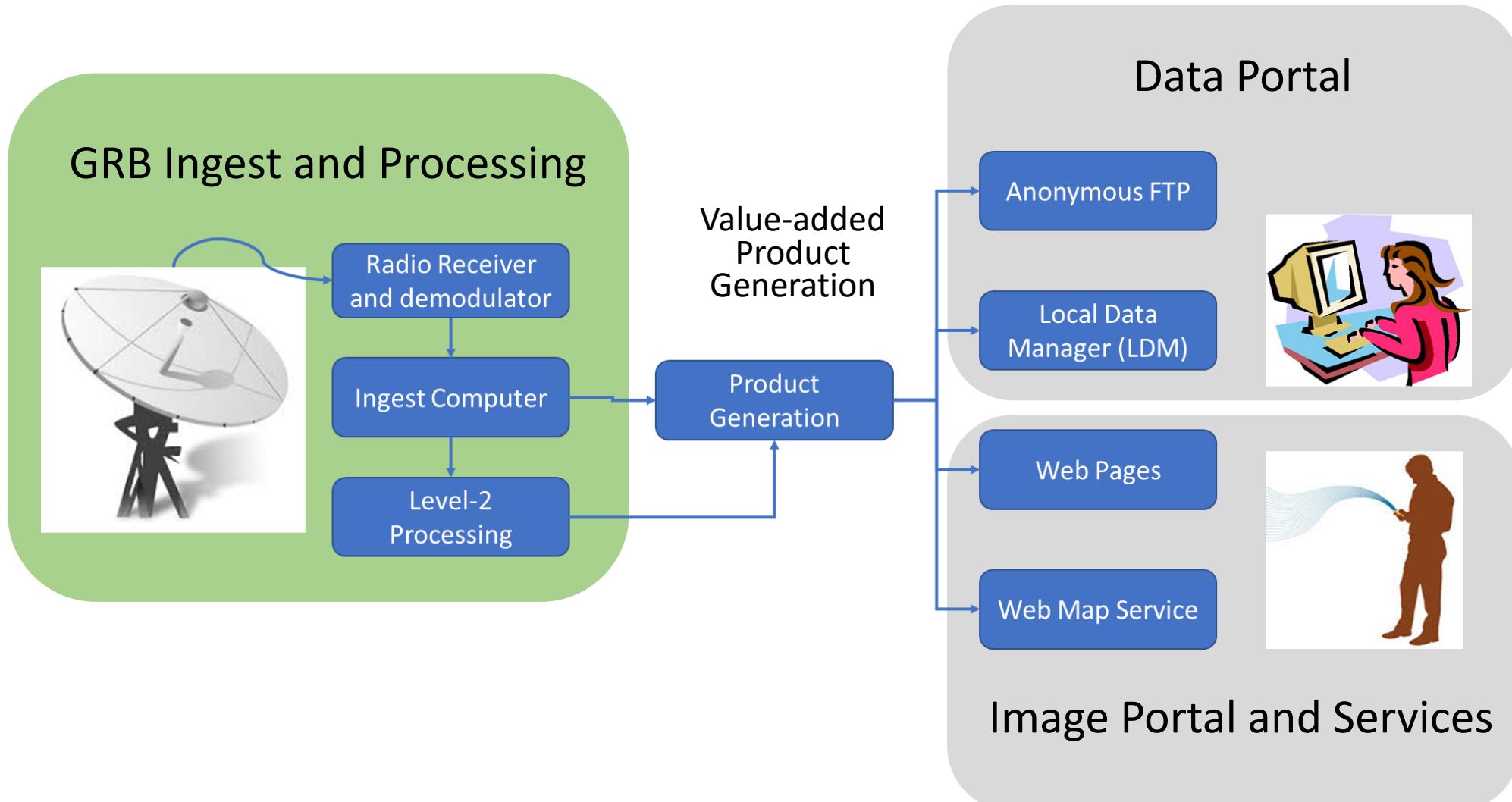
Acquisition and Data Processing



Visualization

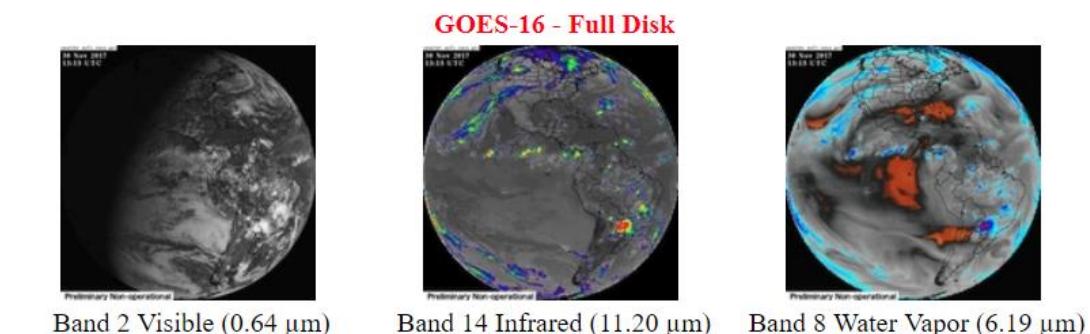


GRB Data Reception and Dissemination

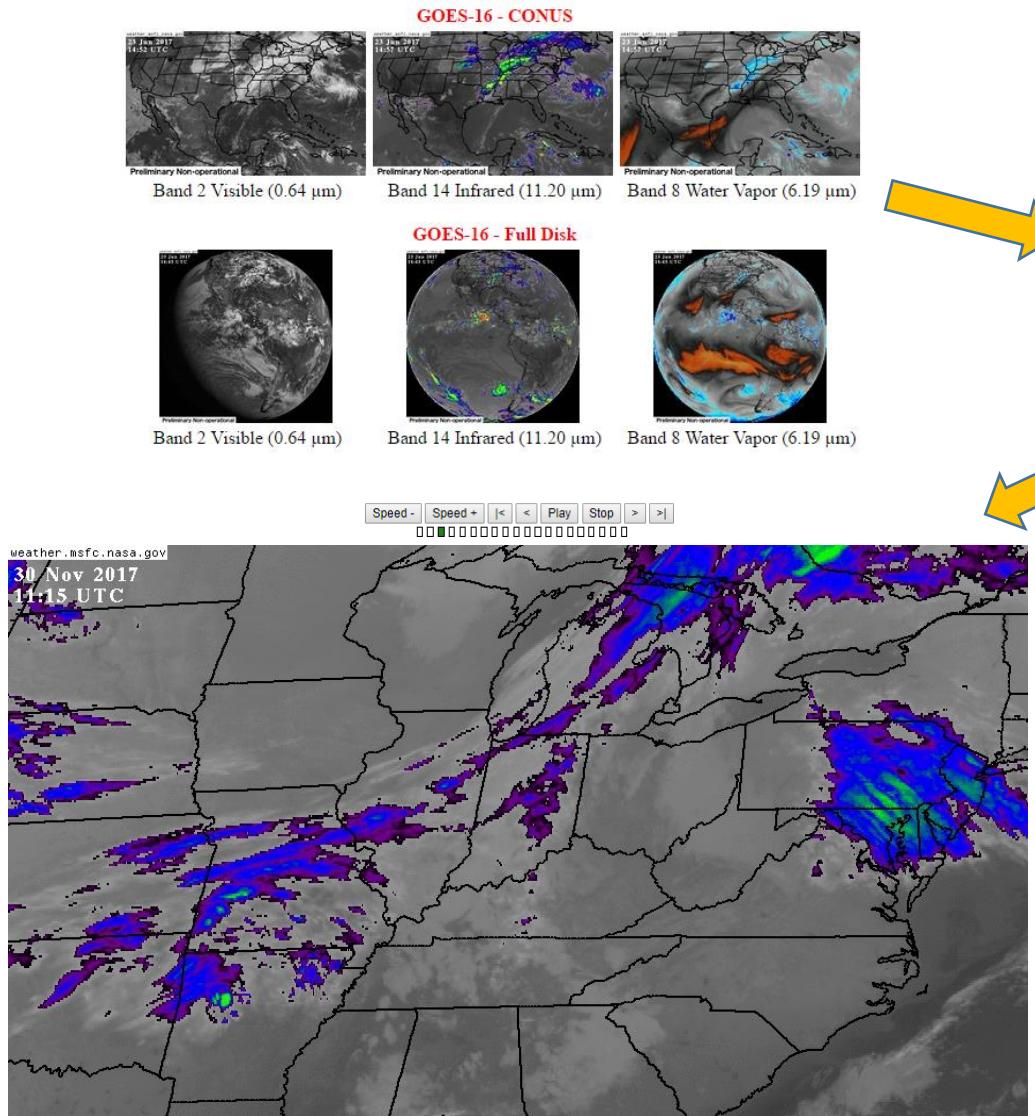


Classic Web Viewer

- Developed a web-based interactive interface for viewing GOES imagery in 1997
 - ~500,000 unique visitors/month
 - ~50M hits/month
- Select channels (0.64 μ m, 6.2 μ m, 11.2 μ m)
- Users define area of interest to display
- Animations are very quick to load
- Options:
 - Color palettes
 - Map overlays
 - Quality
 - Resolution
 - Width/height
 - Static or animation



Classic Web Viewer



GOES-16 Wavelength: 11.20 μm Channel: 14 Resolution: 2 km

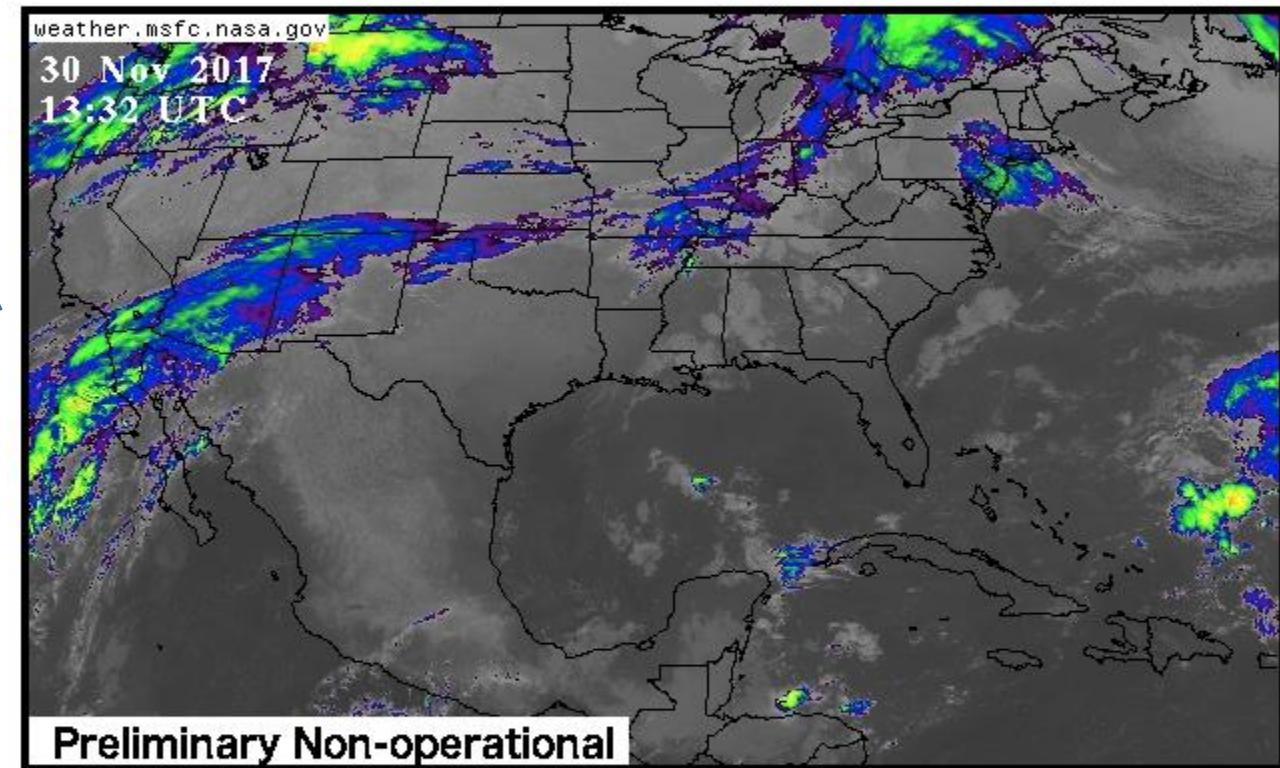
Used for: Imagery, sea surface temperature, clouds, rainfall.

Additional sectors / channels (hover over elements for description):

Choose

30 Nov 2017 15:53:16 UTC

30 Nov 2017 09:53:16 AM Local



Set controls below then click anywhere in the image to zoom.

Show a Single Image or an Animation as a 20 image loop

Output Image (pixels): Width (100-1400): Height (100-1000):

Quality: 75% Zoom Factor: High

Map: Standard Map Color: Black

Enhancement: IR2 Display color bar (IR2 only): Yes

Animate image above (choose image loop length above)



<https://weather.msfc.nasa.gov/GOES/>

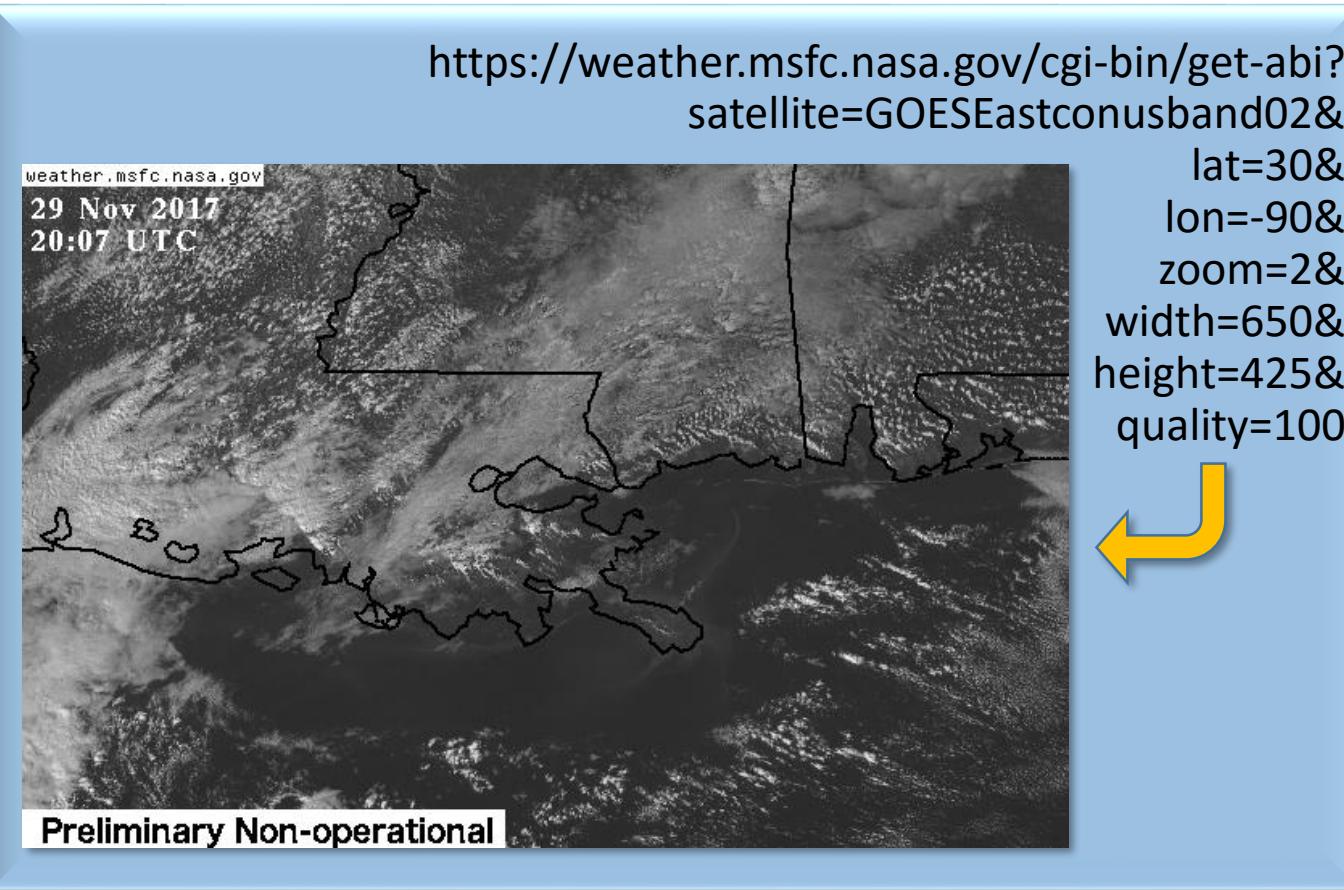
Classic Viewer Application Programming Interface

- Provides a method for requesting single images or a series of images via specially-constructed URLs
- Requests can be submitted with common commands like get and curl
- Scriptable
- Easy to integrate real-time imagery into web pages and apps
- Popular with social media users
- Documentation:

<https://weather.msfc.nasa.gov/goes/abi/wxSatelliteAPI.html>

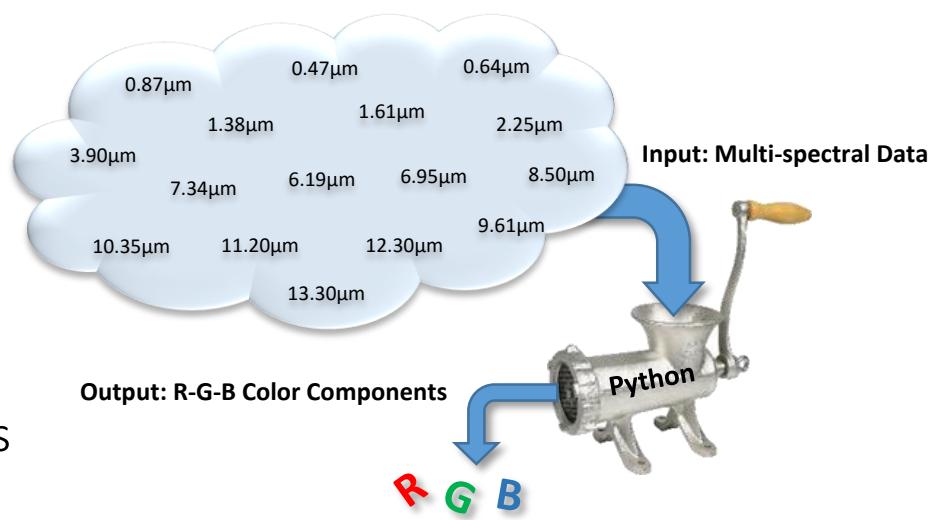
Usage Example to Request Single Image

`https://weather.msfc.nasa.gov/cgi-bin/get-abi?
satellite=GOESEastconusband02&
lat=30&
lon=-90&
zoom=2&
width=650&
height=425&
quality=100`

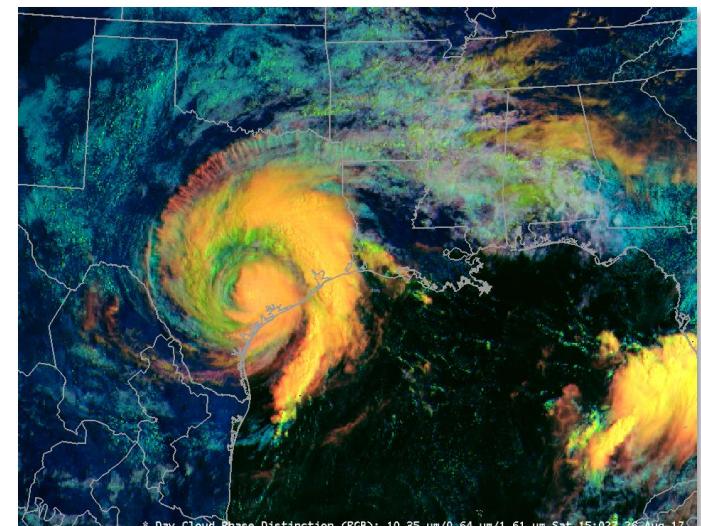


Client-Side RGB Generation

- New version of NWS display system (AWIPS II) allows developers to expand capabilities
- SPoRT developed client-side RGB capability
 - No modifications required to base code
 - Python implements EUMETSAT recipe for simple /advanced RGBs
 - Recipes defined via XML files, allowing for adjustments and new recipes
 - Greater color fidelity (24-bit)
 - Sampling
- Provided capability to NWS Operations Proving Ground to support AHI RGB demonstration
- NWS is deploying capability to all offices for GOES-16 with 13 RGBs initially available

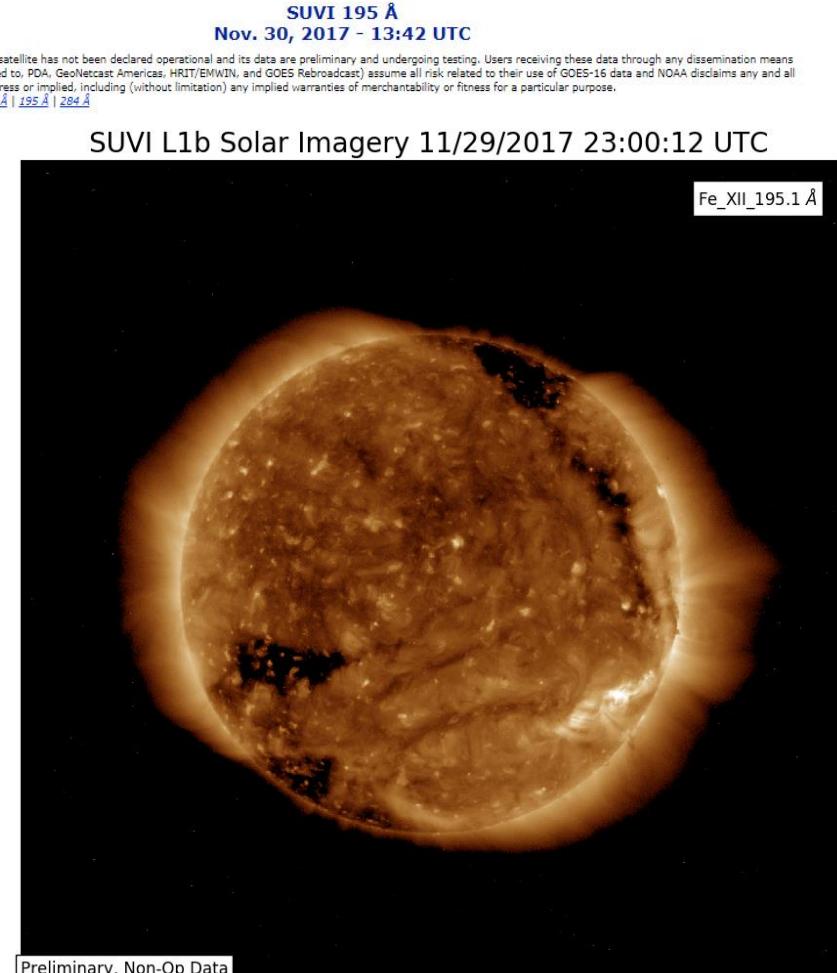
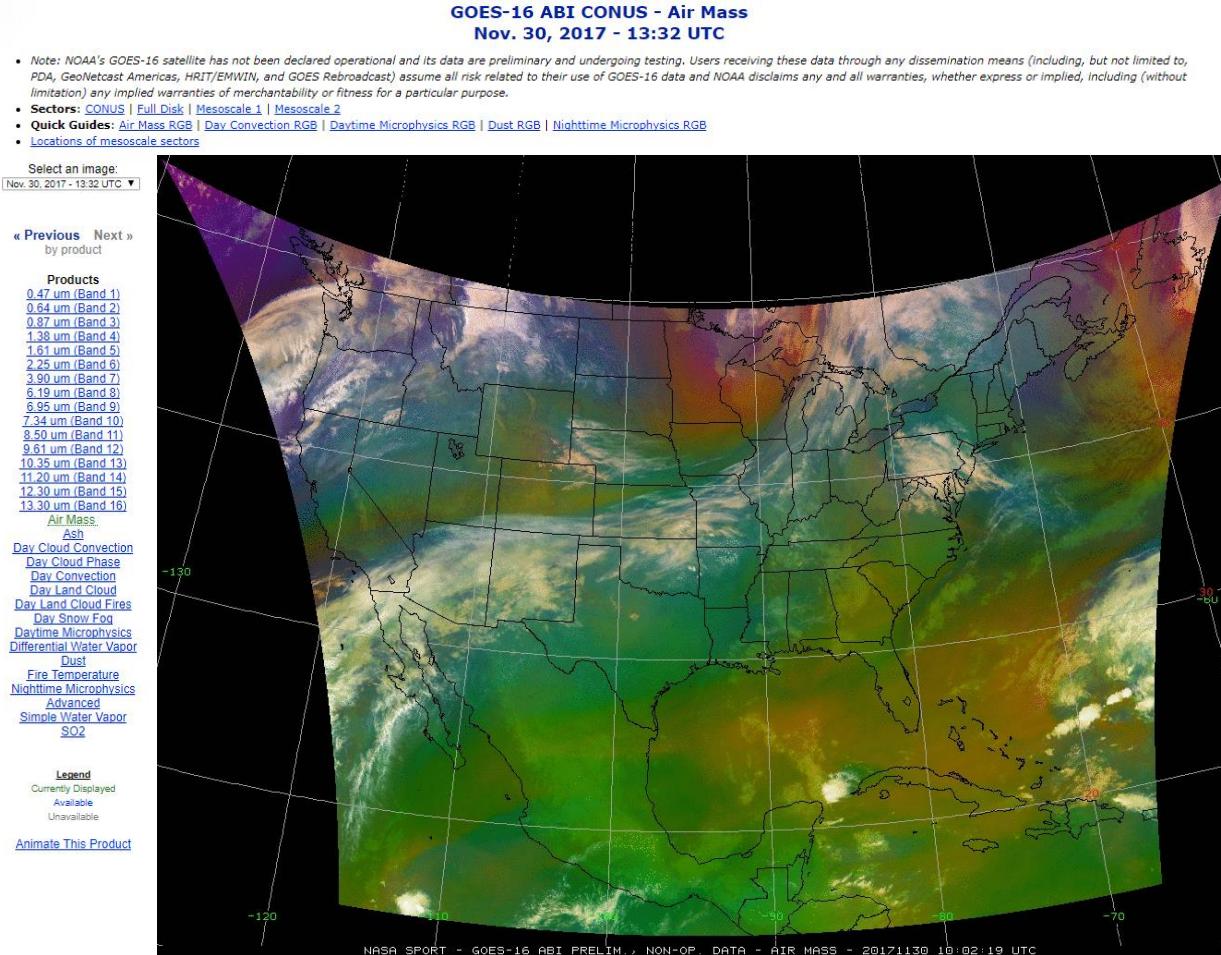


- Implements RGB Recipe:
$$\text{Byte} = 255 \times \left[\frac{\text{Value} - \text{Min}}{\text{Max} - \text{Min}} \right]^{1/\text{Gamma}}$$
- Computes 8-bit value for each R-G-B color



Quick-Look Images

- Used to verify data integrity for all geostationary products
- Supports long animation sequences
- Fixed resolutions

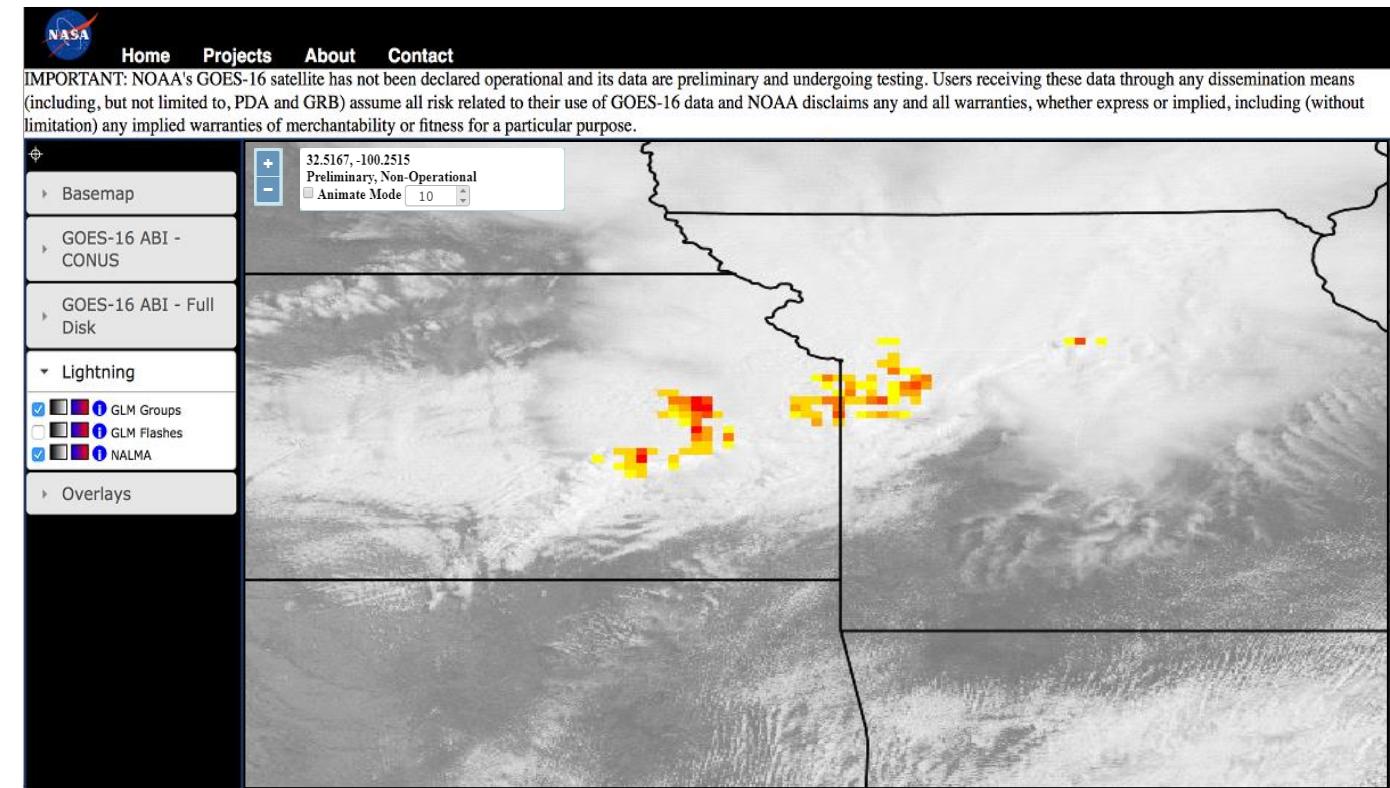


<https://weather.msfc.nasa.gov/cgi-bin/sportPublishData.pl?dataset=goes16abiconus>
<https://weather.msfc.nasa.gov/cgi-bin/sportPublishData.pl?dataset=goes16suvife195>

Web Map Service

Provides an Open Geospatial Consortium standard protocol for serving georeferenced images

- WMS service currently being provided by GeoServer
- Supports various requests to list imagery, generate images in various formats, get legends, etc.
- Access methods:
 - Custom interactive web interface based upon OpenLayers
 - Interface from GIS applications
- Transitioning to Esri Enterprise Server to increase ease of sharing layers with other GIS users



GLM 2-Minute Groups Overlaid on ABI 0.64μm in WMS Web Interface



Summary/Future

- Visualization and dissemination of real-time data
 - ABI
 - Addition of mesoscale sectors and unique NASA products
 - GLM
 - Implement display in classic viewer
 - Space weather instruments
 - SUI: Create quick-look displays
 - EXIS, MAG, and SEISS: Visualize temporal changes as graphical plots
 - WMS
 - Improved animation
 - Migration to Esri ecosystem
- Integrate NASA unique value-added products as part of the GOES L2 processing within CSPP
- Acquire a second GOES-R series receiving station – replicate visualization and dissemination capabilities

